

The South Carolina's Governor's School for Science and Mathematics

27th Annual Graduation, 28 May 2016, DeLoach Center, Hartsville, SC

Address to the Graduates: Margaret B. Bailey, Ph.D., P.E., Rochester Institute of Technology

Opening

Congratulations to you and thank you for the opportunity to address the class of 2016 from the SC Governor's School for Science & Mathematics. I'm thrilled that President Flores who is a close friend and trusted colleague from our time together at RIT asked me to serve as your commencement day speaker this year. I can feel the excitement and energy in the air, which is very fitting because this milestone marks the start of the next phase of your lives, your college experience. I wonder how you are feeling – perhaps a combination of confidence, optimism and happiness coupled with a little uncertainty and anxiety. To keep your mind focused on the promise of your future, I'm going to offer all the inspiration, hope, humor (which can be difficult coming from a thermodynamics professor), and advice that I can in the next few minutes. Graduates, you are my target audience and let's talk about you and let's focus on the path ahead. I'm imaging you as future leaders with educational backgrounds in engineering, science, math, the arts and humanities. Leaders, who when they were just starting out in high school, chose a difficult path to follow by pursuing admittance into this school and ended up as a student here where you have had the opportunity to study with excellent faculty in an environment designed to optimize your intellectual development. Plus, because this is hard work, you were placed in a scenario where in order to thrive and succeed you saw the value in building relationships with each other, to lean and learn from each other, all while pursuing deeper knowledge. You are a group of remarkable young people who already have a foundation in math and science and who will continue to strengthen this foundation with more in-depth studies at schools like Clemson, Pitt, UNC, and the College at Charleston.

Convergence of Disciplines

I would like to draw upon some of my unique past experiences as an engineering professor to offer you some ideas to consider as you embark on this next phase of your life. I'll start by sharing something that may be a bit surprising to someEven though I have a Ph.D. and a P.E. after my name and a 34 page resume, I continue to be impressed by the general intellect and abilities of my college students...over the years, I've encountered many young people that take my breath away because of their promise,

because of their potential. Students like these, and you are currently these types of students and will ideally continue to be so in college, push faculty to become better, just so we can stay ahead of you and continue to challenge you. An area where I can recognize more and more growth and ability within my students is their ability to operate at the connection between two different disciplines or where **“disciplines converge”**. An example of disciplines converging is architectural engineering which is a discipline which exists between the intersections of architecture and engineering, my degrees are in this area which led me to study building energy use and controls and thermodynamics and now I am a faculty member within mechanical engineering. Back to students’ growing abilities to manage converging disciplines, this is where innovation and creativity are boundless. In the future, engineers and scientists who are educated in and focus on a single discipline in a manner that’s traditional may not succeed in tomorrow’s world. **Embrace the convergence of disciplines** especially when it engages both the analytical left-brain and creative right-brain. Look for opportunities to accomplish this convergence, such as combining non-conventional degree programs, such as engineering with psychology or computer science with fine art or biology with organizational behavior.

Keep in mind that you may be a force within your university that is pushing for this change as faculty strive to stay a step ahead of you. In the coming decade, more and more opportunities will become available however, many faculty and academic programs are just at the beginning of embracing this concept, especially those of us within the traditional disciplines of engineering.

Even if you don’t choose to pursue a unique dual major combination, I urge you to seek out opportunities for lectures and experiences that involve unlikely partners. One of my favorite past educational experiences was when I team taught a series of lectures within a modern poetry class with a faculty member from English. We focused on how electrification (or the distribution of electricity) which began in the 1890’s in NYC impacted the language used by poets, especially those living in the city or in the areas which were greatly affected by the coal mining needed to keep up with demand. As a thermodynamics professor, I taught non-technical students about how electricity is created using coal and the environmental impact associated with early coal mining. Because poetry is like a mirror into our society’s soul, we explored what was happening within the lives of the people within NYC and the coal country of PA as these rapid changes unfolded. For example as more wires were hung in NYC in order to meet demand for lighting in a market with little to no regulation or electricity codes, sunlight actually began to be blocked on some city streets, that’s how many wires were present overhead. As workers sought to keep up with demand, some were electrocuted because of faulty electrical lines and an

overabundance of them and people within the city were horrified by the results. My colleague explored how all of these changes impacted the language used by poets and how terms began to appear in their work such as “incandescent” “illumination” and “electrification”. Exploring this topic in such a **convergent manner** between thermodynamics and modern poetry was an exceptional learning experience for all of us. This experience changed the way that I taught the concept in Thermodynamics. Although the series was promoted heavily to the engineering community within RIT, most of the people who attended were in majors outside of engineering, and I urge you to seek and embrace these types of experiences during your college years.

Change

My second message relies on the assumption that you will become scientist, engineers, lawyers and doctors who are comfortable outside of their traditional area of study, people who have embraced the energy and excitement of the convergence of disciplines. In this mindset, you will be more likely to ask the right questions, which is so crucial in this current time when there are so many unanswerable questions. And that you will engage in solving and addressing complex issues that exist in our world. The world needs leaders like you with strong technical and scientific backgrounds to address and hopefully solve some of our planet’s greatest challenges. As an engineering, math or science undergraduate, I urge you to consider what changes are needed around you, how people are addressing these opportunities, and how you would address them. **Begin to see yourself as an evolving leader of change.**

Your life thus far has centered on education and today marks an important accomplishment in this journey, and an exciting time. And, from a learning standpoint it is just the beginning. It has also been said that the only **constant in life is change**. And this is very true. Ironically, the things that we need most – for innovation, sustainability, peace, and the environment – is so often the hardest thing to do. Just like it is easy to follow the flow, the impetus for change is often dampened by the weight of the status quo. If you are observant, during your college years you will be able to see and experience the inertia that resists change because of the factors of size, complexity and tradition. I can assure you at times you will feel that there is little you can do to make a difference. To this I want you to remember a quote by Margaret Mead, a famous anthropologist and activist during the 1960’s and 70’s:

“...Never doubt that a small group of thoughtful, concerned citizens can change the world. Indeed it is the only thing that ever has.... “

I'll briefly draw upon my personal experiences in this regard and shape these into some advice for you. I have been a part of many of these "small groups" and have experienced what it's like to motivate important change. My skills and education as an engineer who is comfortable where disciplines converge and where complexity exists have been great assets to me during these change journeys as well as resilience, strategic thinking, and drive – topics for another discussion. Back to change, as an undergrad in architectural engineering and one of 7 women in my class of 90, I started to question why there were no women teaching me engineering, math, science at college? In high school I had some exceptional women teachers and in college, the 7 women students in my program were at the top of my overall class, so it didn't seem as if there was some cognitive intelligence based reason why there were no women teaching us. I didn't just ask myself this once, I thought about it often, and there wasn't an ongoing dialogue on the topic within my college so it wasn't a "safe" or "accessible" topic for me to really explore as an undergrad. But I listened to that simple question and thought about it and it slowly turned into an interest area and ultimately a driver of passion for positive change and this seed was planted during my undergraduate years. It led me to begin the first ever Society of Women Engineering student section at West Point while on the faculty there and to create comprehensive recruitment and community building programs at RIT which helped to triple the representation of women students in undergraduate engineering programs.

About 9 years, I started questioning what the status was like for women faculty on my campus in regards to how they were navigating their careers. I led a self-study effort with a small group of dedicated and thoughtful colleagues funded through the National Science Foundation to answer this question through a detailed study. We assembled and analyzed data from faculty records, climate surveys, and benchmarking – after 3 years of careful study, we disseminated results which revealed barriers for women faculty in regards to climate, work/life integration, and career navigation. Most importantly, the study revealed opportunities for enhancing our academic organization.

This same small group, took these opportunities and shaped them into a detailed, comprehensive strategic plan to motivate important organizational change within our campus. A shared passion to expand the safe places on our college campus where authentic dialogue could occur regarding gender equity and the inclusion of those who are different in some way from the majority, has led me and this team to embark on a large, institutional transformation project at RIT which is funded again by the National Science Foundation. I'm the lead on this \$4M multi-year effort which is aimed at transforming our campus culture to become a place where more women faculty will join us and thrive through their

academic careers in STEM. There will be more women within those classes to serve as important role models for our students and to offer unique and different perspectives along the way. Therefore, the seeds that were planted in my mind as an undergrad sitting in 5 years of intensive engineering classes at Penn State as I wondered “where are all of the women on this faculty”, those seeds grew into shaping me as a person who questions things and dreams up possible solutions. I urge you to do the same.

Closing

As a professor I feel compelled to give you all one last assignment....but this is for you, not me. Take some time within the next week, two at the most, and find a place where you are centered and can think about where you are right now. I find the outdoors is a place I can go to reflect deeply. I am sure each of you has some place special that you are at your best in this regard. Capture the accomplishment, the aspiration, the energy, your vision and hope for your future. Write it down, or at least some framework that represents where you are right now, today, in your life so you can pull it out as a reminder of the path you have for yourself. It may not be complete, and certainly will change over time, but capturing and retaining this moment represents the purpose you all have, and have in mind, that you cannot afford to forget or lose sight of.

In closing, I urge you to remember these two things – seek out opportunities **to operate at the convergence of disciplines where innovation is boundless and unanswered questions can be more readily addressed. And couple this with the knowledge that anyone including you can make a significant difference in the world.** You are well-equipped and ready to build your future, to affect all of ours, and to leave the legacy that the celebration of today intends for you to have.

Thank-you